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A review on phytotherapeutic approaches for scalp and hair wellness by herbal onion oil

Ganta Reddy Rani *, Manchikalapati Bhargavi, Yadala prapurna Chandra, Afroz Patan and Venugopalaiah

Ratnam Institute of Pharmacy, Pidathapolur (V&P), Muthukur (M), SPSR Nellore District -524 346.

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Abstract

Onion (*Allium cepa* L.)-derived preparations ,including onion juice and onion oil have been increasingly investigated as phytotherapeutic agents for scalp and hair wellness due to their rich phytochemical profile (sulfur-containing compounds, flavonoids, vitamins and trace minerals). Several clinical and preclinical studies report that topical application of onion juice or onion formulations can improve hair regrowth in patchy alopecia areata, reduce microbial load on the scalp, and support follicular health through antioxidant and anti-inflammatory effects. Mechanistically, Allium cepa constituents are proposed to enhance local microcirculation and nutrient delivery to hair bulbs, support keratin synthesis via sulfur donation, and exert antimicrobial/antifungal activity that helps control dandruff and scalp infections. Formulation factors (concentration, carrier oils, extraction method, and co-ingredients) strongly influence efficacy and tolerability; standardized extracts and controlled clinical trials remain limited. This review synthesizes clinical trials, animal studies, and phytochemical analyses to present an evidence-based appraisal of onion-based hair therapeutics, identifies knowledge gaps, and suggests priorities for standardized formulation development and rigorous clinical evaluation.

Keywords: *Allium cepa;* Phytotherapy; Hair Growth; Onion Oil; Onion Juice; Scalp Health; Antioxidants; Antimicrobial; Alopecia

1. Introduction

Hair is essential to human existence. In India, the custom involves mixing different medications that promote hair growth with hair oils. The preparations for hair oil are included to treat split ends, dandruff and other issues. Now a days hair loss and dandruff in hair is major problems associated with hair in both women and men's.

Therefore, it has great importance to develop the new theories for the treatment of hair problems. Along with the good shampoo and conditioner, great hair oil completes hair care.[1] The main purpose of hair oil preparations is to cool the scalp in order to promote luscious hair development in both men and women.[2] Making an herbal hair oil using multiple herbal powders, Herbal juices and base oils involves a Decoction process that extracts the beneficial properties of the herbs into the oil. Here's a step-by-step procedure to create an effective herbal hair oil for hair loss, hair regrowth & powerful antidandruff. Hair follicles are highly sensitive structures that can be damaged by various factors, including environmental pollutants, UV radiation and inflammation.[3]Herbal medicines derived from plants are believed to be safe in the treatment of various diseases.[4]

* Corresponding author: Ganta Reddy Rani

1.1. Historical Context of Onion

1.1.1. Origin and Early Domestication

- Onions are believed to have been domesticated over 5,000 years ago.
- The precise origin is uncertain; many researchers point to Central Asia, Iran, Pakistan, Afghanistan, or Northwest India as likely regions.

1.1.2. Use in Antiquity

- Ancient Egypt used onions around 3,500 BC; they were important in daily diet, as well as in religious or ritual contexts.
- Egyptian workers (e.g. those building the pyramids) were reportedly fed onions for strength.
- Onions appear in Babylonian tablets (~17001600 BC) in recipe form.

1.1.3. Cultural, Symbolic, and Medicinal Roles

- Egyptians considered the onion symbolic of eternity due to its concentric layers, and included bulbs in burials and mummification.
- In ancient Greek and Roman times, onions were used both as food and medicine; for example, athlete's diet (Greece), and Roman writings (Pliny the Elder) describe medicinal uses for eyes, mouth sores, etc.

1.1.4. Spread and Later History

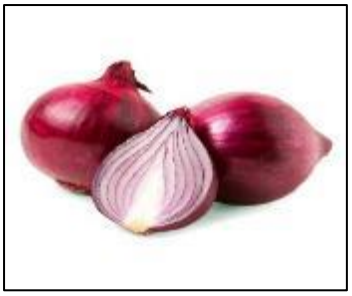
- Onions spread through Europe with the Romans, and became staple crops in the Middle Ages, eaten by both commoners and elites.
- In India, ancient texts like Charaka Samhita (approx. 6th century B.C.) mention onions for digestive health and other remedies.

1.1.5. Modern Interest and Research

- Today onions are not only a major food crop globally, but also studied for medicinal and nutritional benefits (e.g., antioxidant, anti-inflammatory properties). (5)

Table 1 Types of herbs

Herb	systemic position	figure	uses
Curry leaves	Kingdom : *Plantae* Clade : *Tracheophytes* Order : *Sapindales* Family : *Rutaceae* Genus : *Bergera* Species: *B.Koenigii*		Prevents hair fall and early graying of hair.6)
Amla	Kingdom : *Plantae* Clade : *Tracheophytes* Order: *Malpighiales* Family: *Phyllanthaceae* Genus :*Phyllanthus* Species: *P. Emblica*		Hair conditioner, treats scalp ailments, helps hair growth.7

Aloe vera	Kingdom : *Plantae* Clade : *Tracheophytes* Orde:*Asparagales* Family : *Asphodelaceae* Genus : *Aloe* Species : *A. Vera*		It acts as a great conditioner and leaves your hair all smooth and shiny. It promotes hair growth, prevents the itching on the scalp, reduces dandruff and conditions your hair.8
Parijat	Kingdom : *Plantae* Clade : *Tracheophytes* Order : *Lamiales* Family : *oleaceae* Genus:*Nyctanthes* Species : *N. arbortristis*		relief from hair fall Juice of Parijat flower or paste of the seeds, when applied to the scalp, can give quick results and also promote hair growth.9
Brahmi	Kingdom : *Plantae* Clade : *Tracheophytes* Order : *Lamiales* Family :*scrophulariaceae* Genus : Bacopa Species : *B. monnieri*		Removes dryness, longing and cracking.10
Tulsi	Kingdom : *Plantae* Clade : *Tracheophytes* Order : *Lamiales* Family : *lamiaceae* Genus : *Ocimum* Species :*O.tenuiflorum*		Strengthen hair strands and prevent hair loss.11
Onion	Kingdom : *Plantae* Clade : *Tracheophytes* Order :*Asparagales* Family:*Amaryllidaceae* Genus : *Allium* Species : *A. cepa*		It reduces hair loss by cultivating blood circulation in the scalp and hair. The sulfur in the juice helps in the production of the essential collagen that promotes hair growth.12

Fenugreek Seeds	Kingdom : *Plantae* Clade : *Tracheophytes* Order : *Fabales* Family : *fabaceae* Genus : *Trigonella* Species: *T.foenum-graecum*		Recovers damaged hair, controls scalp inflammation, adds shine and soft texture.13
Hibiscus	Kingdom : *Plantae* Clade : Tracheophytes Order : *Malvales* Family : *malvaceae* Genus : *Hibiscus* Species : *Rosa sinensis*		Improve hair growth, cures dandruff and itchiness, prevents premature grayish.14

1.2. Mechanism of Action of Onion and How It Works

Onion (Allium cepa) exerts multiple biological effects, largely attributed to its rich phytochemical composition, including flavonoids (notably quercetin), sulfur-containing compounds (like thiosulfinates), vitamins, and minerals.

1.2.1. Antioxidant Activity:

Onions contain high levels of quercetin and other flavonoids, which scavenge free radicals and reduce oxidative stress. This helps in protecting cells from damage caused by reactive oxygen species (ROS) and may contribute to anti-inflammatory and anticancereffects.(1)

1.2.2. Anti-inflammatory Effects:

Sulfur compounds in onion inhibit enzymes like cyclooxygenase and lipoxygenase, reducing the synthesis of pro-inflammatory mediators such as prostaglandins and leukotrienes, thereby modulating inflammatory pathways.(15)

1.2.3. Antimicrobial Properties

Thiosulfinates (e.g., allicin derivatives) exhibit bactericidal and fungicidal activities by disrupting microbial cell membranes and inhibiting enzyme function, making onion useful in traditional medicine for infections.(16)

1.2.4. Cardiovascular Benefits

Onion components help reduce blood pressure and cholesterol levels, likely by improving endothelial function and inhibiting platelet aggregation, reducing the risk of atherosclerosis.(17)

1.2.5. Hair Growth Promotion

Onion juice and extracts stimulate hair follicles by improving scalp circulation and supplying sulfur and antioxidants that strengthen hair keratin. The anti-inflammatory and antimicrobial properties reduce scalp conditions that cause hair fall.(18)

1.3. Clinical Applications and Evidence for Phytotherapeutic Approaches Using Herbal Onion Oil for Scalp and Hair Wellness

1.3.1. Treatment of alopecia areata

Topical application of onion juice or onion oil has shown promising results in promoting hair regrowth in patients with alopecia areata. A randomized controlled trial demonstrated significant hair regrowth after six weeks of daily application, attributed to onion's rich sulfur content and antioxidant properties stimulating follicular activity.(19)

1.3.2. Antimicrobial Effects Reducing Scalp Infections

Herbal onion oil exhibits potent antimicrobial activity against common scalp pathogens like Staphylococcus aureus and Malassezia species, which are implicated in dandruff and seborrheic dermatitis. Regular use helps reduce scalp inflammation and microbial load, improving overall scalp health.(20)

1.3.3. Enhancement of Hair Strength and Shine

Clinical studies reveal that onion oil, with its high content of flavonoids and sulfur compounds, improves hair shaft strength and elasticity, reducing hair breakage and enhancing hair shine and texture when used as a topical treatment.(18)

1.3.4. Anti-inflammatory Benefits

Onion oil's anti-inflammatory effects reduce scalp irritation and itching, commonly associated with hair loss conditions and scalp disorders. This facilitates a healthier environment for hair follicle function.(15)

1.3.5. Combination Phytotherapy

Combining onion oil with other herbal oils such as coconut or rosemary has been shown to have synergistic effects on hair growth, combining antimicrobial, antioxidant, and circulation-boosting properties for enhanced scalp and hair wellness.(21)

2. Hair structure

Hair is made up of two separate structure- first shaft, which comprise the visible part outside the skin and second is the hair follicle which lies underneath the skin surface.27 Hair shaft that we can see, they do not survive after coming up, Hair shaft is three layers of keratin-Inner layer, middle layer and outer layer Inner layer is called as medulla, middle layer is called as cortex. Medulla and cortex are pigmenting cell and outer layer is called as cuticle. Socks-like structure from where hair begins to grow, it is called Hair Coup. Which extends from Epidermis to Dermis. The roots of the hair are found from the blood vessels named Nutrition Papilla. Rome also has a germinal matrix where new Romes are found.(24)

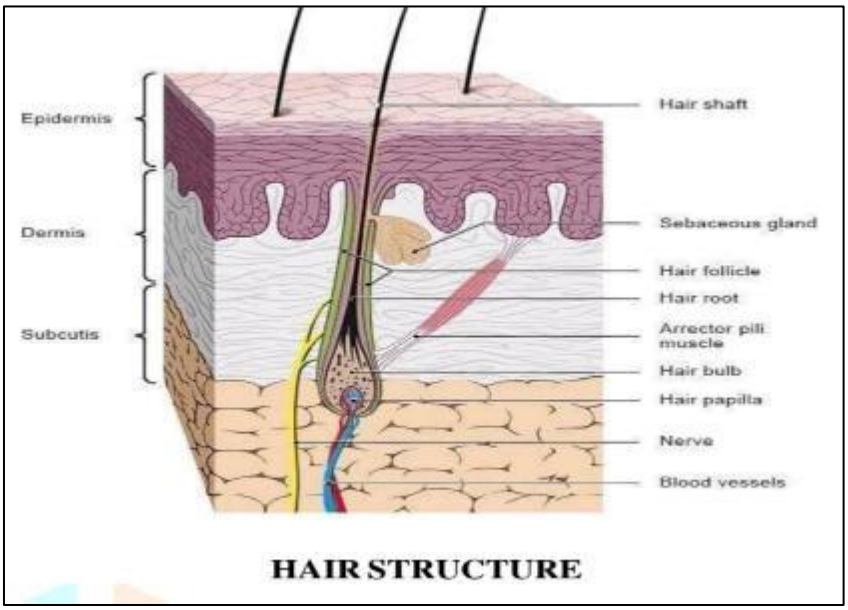


Figure 1 Structure of hair

2.1. Key Principles of Synergistic Formulation

Base Oils as Carriers

2.1.1. Oils like coconut, sesame, castor, and almond serve as carriers to:

- Enhance penetration of active compounds into hair follicles
- Provide nourishment and reduce protein loss in hair strands.(22)

2.1.2. Onion as Primary Active

- Onion (Allium cepa) is rich in sulfur, quercetin, and thiosulfinates that:
- Stimulate keratin production o Improve scalp circulation
- Offer anti-inflammatory and antimicrobial effects.(1)

2.1.3. Complementary Herbs and Their Synergy

- Amla (Emblica officinalis): antioxidant and DHT-blocking activity o Bhringraj (Eclipta alba): known for hair growth stimulation o
- Hibiscus (Hibiscus rosa-sinensis): conditioning, anti-dandruff
- Neem (Azadirachta indica): antifungal and scalp-cleansing
- Fenugreek (Trigonella foenum-graecum): strengthens hair shafts.(2,7)

2.2. Evidence from Research

Polyherbal formulations with onion oil and complementary herbs have shown:

- Faster hair regrowth in animal studies
- Reduced scalp irritation and microbial infections
- Higher patient satisfaction in preliminary clinical studies.(19)

3. Preparation of onion extract

Fresh onion bulbs are washed, peeled, and chopped into small pieces. The extraction can be carried out using one of the following methods:

- Cold maceration: Chopped onions are soaked in a solvent such as coconut oil or ethanol for 48–72 hours with intermittent shaking, followed by filtration.(25)
- Soxhlet extraction: Dried onion powder is extracted with ethanol or hexane to obtain a concentrated extract rich in volatile and sulfur compounds.(26,28)
- Steam distillation: Used to extract onion essential oil for incorporation into the final formulation.(27,29)

3.1. Practical Considerations of Using Herbal Onion Oil for Scalp & Hair Wellness

3.1.1. Purity, Quality & Extraction Method:

- Use highquality onion extract / oil: extraction method (coldpressed, solvent extraction, infusion) affects active compound yield (sulfur compounds, flavonoids).
- Ensure minimal contamination (pesticides, microbial load) and use of good manufacturing practices.

3.2. Formulation Base & Carrier Oils:

- Blending onion extract/oil with appropriate carriers (coconut oil, sesame, almond, castor, etc.) helps improve skin penetration and reduces irritation.
- Consider adding other herbs (like neem, hibiscus, amla) to provide complementary effects (antimicrobial, antioxidant).

3.3. Frequency & Duration of Application:

- Regular use over several weeks is typically needed to observe effects (hair regrowth, reduced fall).
- Intermittent use may be less effective; continuous treatment with safe breaks is better.

3.3.1. Concentration & Dosage

- Optimal concentration of onion extract/oil needs balancing: sufficient levels to exert activity, but not so high as to cause irritation.
- Patchtesting is advisable, especially for sensitive scalps.

3.3.2. Safety & Tolerability

- Risks include: skin irritation, allergic reactions (especially in people sensitive to onions or Allium species), strong odor.
- For people with eczema, psoriasis, or damaged scalp barrier, extra caution. o Avoid contact with eyes and mucous membranes.

3.3.3. Cosmetic Acceptability

- Odor masking (with essential oils, fragrance agents) may improve compliance.
- Texture, viscosity, feel on application matter for user acceptability.

3.3.4. Complementary Practices

- Hair hygiene, dietary support, stress management are important adjuncts.
- Avoid harsh chemical treatments or overwashing that might negate benefits.

3.3.5. Regulatory & Labeling Aspects

- Clearly label ingredients, concentration, usage instructions.
- Claims should be supported by evidence; verify regulatory compliance.(23)

3.4. Phytoconstituents of onion(allium cepa)

Onion (Allium cepa L.) is a widely cultivated medicinal and culinary plant belonging to the family Amaryllidaceae. It is rich in diverse phytoconstituents responsible for its therapeutic and cosmetic properties, including antioxidant, antimicrobial, and hair growth–promoting effects. The bioactive compounds are mainly organosulfur compounds, flavonoids, phenolic acids, saponins, and essential oils.

3.4.1. Organosulfur Compounds

The characteristic odor and therapeutic potential of onion are largely attributed to its sulfur-containing compounds such as S-alk(en)yl-L-cysteine sulfoxides (ACSOs), thiols, thiosulfinates, and sulfides. These compounds are enzymatically converted into volatile sulfur compounds like allyl propyl disulfide, diallyl disulfide, and allicin, which exhibit antimicrobial and anti-inflammatory activities beneficial for scalp health. Sulfur plays a vital role in keratin synthesis, promoting stronger hair shafts and reduced breakage.(15,30)

3.4.2. Flavonoids

Flavonoids such as quercetin, kaempferol, and isorhamnetin are abundant in onion bulbs and outer layers. Quercetin acts as a potent antioxidant, scavenging reactive oxygen species that contribute to oxidative stress–induced hair follicle damage. It also exhibits anti-inflammatory and UV-protective effects that help maintain scalp health.(31,32)

3.4.3. Phenolic Acids

Onions contain several phenolic acids like caffeic acid, ferulic acid, p-coumaric acid, and gallic acid, which contribute to the plant's total phenolic content and its free radical scavenging ability. These compounds may prevent premature graying and protect hair follicles from environmental damage.(33)

3.4.4. Saponins

Saponins present in onion extracts possess surface-active and antimicrobial properties, enhancing scalp cleansing and improving microcirculation when used topically. They also aid in emulsification in herbal oil formulations.(32)

3.4.5. Essential Oils and Volatile Compounds

The essential oil of onion is rich in allyl propyl disulfide, dimethyl trisulfide, and dipropyl disulfide, which contribute to its antibacterial and fungistatic activities. These compounds inhibit scalp pathogens such as Malassezia spp., reducing dandruff and follicular infections.(34,35)

3.4.6. Vitamins and Minerals

In addition to secondary metabolites, onion contains vitamin C, vitamin B6, biotin, and minerals such as sulfur, selenium, and zinc, all of which support hair growth, collagen formation, and follicular strength.(36)

Table 2 Role of phytoconstituents of onion

Category	Major Compounds	Biological Role in Hair/Scalp
Organosulfur compounds	S-alk(en)yl-L-cysteine sulfoxides, diallyl disulfide.	antimicrobial, anti-inflammatory, Keratin synthesis,
Flavonoids	Quercetin, Kaempferol, Isorhamnetin	Antioxidant, anti-aging, UV protection
Phenolic acids	Caffeic, Ferulic, p-Coumaric acids	Antioxidant, anti-graying, protective
Saponins	Various steroidal saponins	Scalp cleansing, microcirculation
Essential oils	Allyl propyl disulfide, Dipropyl disulfide	Antibacterial, antifungal
Vitamins & minerals	Vitamin C, Biotin, Sulfur, Zinc	Hair growth and follicular nourishment

3.5. Merits of Herbal Oils

Antioxidant activity, helping neutralize free radicals and protect cells from oxidative stress. (37)

- Antiinflammatory effects, reducing inflammation in tissues and modulation of immune response. (38)
- Antimicrobial / Antibacterial / Antifungal properties, useful against pathogens. (39) • Hypoglycemic (blood sugar lowering) effects, helpful in managing diabetes and its complications.(40)
- Immunomodulatory benefits, i.e. influence on immune system function.(40)
- Improved nutritional / metabolic profiles, as some herbal oils also influence lipid profiles or have anticoagulant, prebiotic activity.(41)

3.6. Uses of Herbal Oils for Scalp and Hair Wellness

3.6.1. Promote Hair Growth:

Oils such as rosemary and castor oil are believed to stimulate hair follicles, potentially enhancing hair growth. For instance, rosemary oil has been shown to improve circulation to the scalp, which may encourage hair growth. (42)

3.6.2. Improve Scalp Health

Tea tree oil possesses antimicrobial properties that can help maintain a healthy scalp by reducing dandruff and preventing scalp infections. Its anti-inflammatory effects also soothe irritated scalps. (43)

3.6.3. Enhance Hair Texture and Shine

Jojoba oil closely resembles the natural oils produced by the scalp, making it an effective moisturizer. It helps in reducing frizz and adding shine to the hair.(44)

3.6.4. Strengthen Hair and Prevent Damage

Amla oil, rich in vitamin C and antioxidants, is used to strengthen hair follicles and prevent premature graying. It also conditions the hair, making it softer and more manageable.

3.7. Precautions When Using Herbal Oils:

- Patch Test: Always perform a patch test before using a new herbal oil to check for allergic reactions. Apply a small amount to a discreet area and wait 24 hours to observe any adverse effects.
- Dilution: Essential oils are potent and should be diluted with a carrier oil (e.g., coconut, jojoba, or olive oil) to prevent skin irritation.
- Avoid Sensitive Areas: Keep herbal oils away from sensitive areas such as the eyes and mucous membranes.
- Consultation: Individuals with underlying health conditions or those who are pregnant should consult a healthcare provider before using herbal oils.

3.8. Potential Side Effects of Herbal Oils

- Skin Irritation: Some individuals may experience redness, itching, or a burning sensation upon application. For example, tea tree oil can cause irritation in sensitive individuals.
- Allergic Reactions: Symptoms such as swelling, rash, or difficulty breathing may occur, especially in those allergic to specific plants. Rosemary oil, for instance, can trigger allergic reactions in some people.
- Hair Greasiness: Overuse of certain oils can make the hair greasy, leading to buildup and potential scalp issues. It's important to use the appropriate amount and frequency.
- Headaches: Strong-smelling oils like amla oil may cause headaches or nausea in sensitive individuals.(43)

4. Conclusion

Onion (Allium cepa L.) oil represents a promising phytotherapeutic agent for scalp and hair wellness, combining traditional wisdom with modern scientific validation. Its sulfur compounds, flavonoids, and essential oils exhibit antioxidant, antimicrobial, and keratin-stimulating properties that collectively enhance scalp health and promote hair growth. The integration of advanced extraction methods, nanotechnology, and standardization can further improve its efficacy, stability, and safety. Future studies focusing on clinical validation and sustainable formulation may establish herbal onion oil as a reliable and eco-conscious dermatocosmetic alternative, bridging natural therapy and evidence-based science.

Conflict of interest

No conflict of interest

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